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09/873,287	06/05/2001	Tomio Sugiyama	MNL-2635-16	4759
23117 7590 08/20/2007 NIXON & VANDERHYE, PC 901 NORTH GLEBE ROAD, 11TH FLOOR ARLINGTON, VA 22203			EXAMINER OLSEN, KAJ K	
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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 09/873,287  
Filing Date: June 05, 2001  
Appellant(s): SUGIYAMA, TOMIO

**MAILED**  
**AUG 20 2007**  
**GROUP 1700**

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Michelle N. Lester  
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed May 10, 2007 appealing from the Office action mailed September 19, 2006.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

5,522,979	Tatumoto et al	6-1996
4,961,835	Kobayashi et al.	10-1990
5,419,827	Nanataki et al.	5-1995

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4,105,524	Fujishiro et al.	8-1978
4,851,105	Ishiguro et al.	7-1989
JP-9 26409	Sano et al.	1-1997

JP 08-114,571, 5-1996 (English language abstract only; machine generated translation provided for informational purposes only).

### **(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1, 2, 4-6 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tatumoto et al (USP 5,522,979) in view of either Kobayashi et al (USP 4,961,835) or Nanataki et al (USP 5,419,827) with evidence from the instant invention or Fujishiro et al (USP 4,105,524).

Tatumoto discloses a multilayered gas sensor comprising laminated layers comprising at least one solid electrolyte sheet 2 containing zirconia and yttria (col. 7, ll. 28-33) and at least one insulating sheet 4 containing alumina (col. 8, ll. 44-53). Tatumoto further discloses the presence of a heater 5 directly attached to a side surface of the insulating sheet to transfer heat generated in said heater to said insulating sheet and said solid electrolyte sheet. See fig. 1 and col. 8, ll. 1-6. Tatumoto further teaches that the solid electrolyte sheet and the insulating sheet having the heater are laminated and sintered to be integrally bonded to each other. See col. 8, ll. 54-64. Tatumoto does not explicitly disclose the use of silicon dioxide in the electrolyte of the sensor. Kobayashi teaches that a combination of yttria and silicon dioxide added to the electrolyte creates an electrolyte with a thermal expansion coefficient, which is close to that of non-electrolytic ceramics. See col. 2, ll. 44-57. Nanataki similarly teaches that the addition of silicon

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dioxide to the other stabilizing agents provides a sensor with excellent thermal shock resistance. See the abstract and col. 6, ll. 7-21. It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teachings of either Kobayashi or Nanataki for the sensor of Tatumoto both to make the thermal expansion of the electrolyte as closely match that of the non-electrolyte ceramic 4 and to increase the thermal shock resistance of the electrolyte.

With respect to a crystal phase containing silicon dioxide that intervenes between the solid electrolyte sheet and the insulating sheet, the present disclosure evidences that silicon dioxide adding to the electrolyte followed by subsequent sintering results in the set forth bonding boundary. See page 5, lines 5-17 of the specification. This is further evidenced by the teaching of Fujishiro, which states that  $\text{SiO}_2$  forms a "secondary phase distinct from the solid solution" and "exhibit strong affinity for the above metallic coatings". See col. 5, lines 21-26. Hence it would appear that it was already known in the prior art that materials like  $\text{SiO}_2$  form a phase distinct from the solid electrolyte phase on the surface of the electrolyte (i.e. where the electrodes of Fujishiro are) and assist in the bonding of layers to that electrolyte. It is noted that Tatumoto has the electrolyte 2 bonding both electrode 31 and the insulating sheet 4 on the same surface (see fig. 1), this would indicate that if the  $\text{SiO}_2$  formed a secondary phase next to the electrode (as Fujishiro suggests), then this secondary phase would also be present on the bonding boundary between the electrolyte and the insulating sheet. Because it would have been obvious for Tatumoto to add silicon dioxide to the electrolyte for the reasons set forth above by Kobayashi and Nanataki, said incorporation of silicon dioxide would have inherently resulted in the claimed bonding boundary of the claim.

With respect to the limitations concerning this crystal phase liquefying during the sintering so as to generate material transfer, again this would appear to be the phenomenological result of the addition of silicon dioxide to the electrolyte. See the disclosure, p. 5, ll. 12-17. Again, because it would have been obvious for Tatumoto to add silicon dioxide to its electrolyte for the reasons set forth above, this incorporation would have inherently resulted in the crystal phase liquefying during the sintering.

With respect to the addition of other components to the crystal phase, Tatumoto teaches the addition of other stabilizing agents like MgO and CaO could be utilized (col. 7, ll. 28-33) and Nanataki teaches using a combination of MgO and SiO<sub>2</sub> as a sintering aid (col. 6, ll. 30-37).

With respect to the specified thermal expansion coefficient and the sintering contraction coefficient, this would appear to be a result of the addition of SiO<sub>2</sub> and/or Al<sub>2</sub>O<sub>3</sub> to the electrolyte. Kobayashi teaches adding SiO<sub>2</sub> to the electrolyte to bring its thermal expansion coefficient close to that of non-electrolytic ceramics (e.g. alumina). See col. 2, ll. 54-57. Nanataki teaches the addition of both SiO<sub>2</sub> and alumina to the electrolyte in concentrations overlapping that of the instant invention. Compare col. 5, l. 60 through col. 6, l. 21 of Nanataki with p. 23, ll. 27-31 of the instant invention. Hence, it would appear the specified levels of thermal expansion coefficient and sintering contraction coefficient would be inherent from the addition of SiO<sub>2</sub> or SiO<sub>2</sub> and Al<sub>2</sub>O<sub>3</sub> to the electrolyte as taught by Kobayashi and Nanataki. See also Tatumoto, col. 2, ll. 15-22, 66, and 67 and the alternative rejection below.

With respect to the specified Miller index face, again this appears to be a result of the specified addition of SiO<sub>2</sub> to the electrolyte.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable Tatumoto in view of either Kobayashi or Nanataki as applied to claim 1 above and in further view of Ishiguro et al (USP 4,851,105).

This claim further differs by calling for the bonding boundary to be undulated. Ishiguro discloses a zirconia sheet bonded to an alumina-containing sheet 12 at an undulating boundary. See figure 2(b). It would have been obvious for Tatumoto in view of Kobayashi or Nanataki to adopt the undulating boundary of Ishiguro in order to strengthen the anchoring/bonding of a zirconia sheet to an alumina sheet, as discussed at col. 6, lines 24-41 of Ishiguro.

Claim 5 is rejected in the alternative under 35 U.S.C. 103(a) as being unpatentable over Tatumoto in view of Kobayashi and Nanataki as applied to claim 1 above and in further view of JP 9-26409 (hereafter "JP '409").

In the rejection above, the examiner was of the opinion that the specified electrolyte compositions of Kobayashi and Nanataki inherently established the set forth thermal expansion coefficient. If Kobayashi and Nanataki are deemed to not inherently establish this, then JP '409 discloses that the electrolyte and insulating sheet should have a thermal expansion coefficient difference of between 0 and 0.2%. See p. 4, ll. 7-8 of the translation. It would have been obvious for Tatumoto in view of either Kobayashi or Nanataki to adopt a virtually zero difference between these coefficients, as taught by JP '409, in order to minimize thermal stress. Both Tatumoto and Kobayashi recognized the need for minimal thermal stress. See the discussion above.

Claim 6 is rejected in the alternative under 35 U.S.C. 103(a) as being unpatentable over Tatumoto in view of Kobayashi and Nanataki as applied to claim 1 above and in further view of

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JP 08-114571 (hereafter "JP '571"). The examiner is including a machine translation of JP '571 with this Examiner's Answer to satisfy the requirement that a translation of all foreign language evidence be provided. However, the rejection below continues to only rely on the English language abstract.

In the rejection above, the examiner was of the opinion that the specified electrolyte compositions of Kobayashi and Nanataki inherently established the set forth sintering contraction coefficient. In addition, Tatumoto at col. 2, ll. 15-22, 66, and 67 appears to establish that the electrolyte and insulating sheet already had nearly identical contraction coefficients. If Kobayashi, Nanataki and Tatumoto are deemed to not inherently establish this, then JP '571 discloses such a sintering contraction coefficient difference. See the fourth line from the bottom of the English abstract. It would have been obvious for Tatumoto in view of Kobayashi and Nanataki to adopt this sintering contraction coefficient difference to minimize thermal stress.

#### **(10) Response to Argument**

Appellant urges that Tatumoto does not explicitly nor implicitly disclose the use of silicon dioxide in the electrolyte. Albeit correct, the suggestion of adding silicon dioxides comes not from Tatumoto, but from the secondary teachings of Kobayashi and Nanataki, which did teach the addition of silicon dioxide to electrolyte and gave motivation for doing so.

With respect to the teachings of Kobayashi and Nanataki, appellant urges that neither of these teachings provide any teaching or suggestion of the formation of a crystal phase containing silicon dioxide. However, paragraph 4 of the September 19, 2006 final rejection (this paragraph reprinted above) clearly establishes that the examiner is of the opinion that this formation of a crystal phase is inherent because it is the phenomenological result of adding silicon dioxide to



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the electrolyte. In particular, p. 5, ll. 5-17 of the specification establishes that the crystal phase containing silicon dioxide forms because of silicon dioxide added to the electrolyte mixture liquefies during sintering and forms a bonding layer between the solid electrolyte and the insulating sheet. Both Kobayashi and Nanataki teach the addition of silicon dioxide to the electrolyte mixture followed by a sintering step. See Kobayashi, col. 3, ll. 41-57 and col. 4, ll. 59-61. See Nanataki, col. 6, ll. 7-61, especially ll. 7-21 and 50-61. Tatumoto also establishes that the electrolyte ingredients are mixed together and subsequently sintered. See Tatumoto, col. 7, ll. 28-33 and col. 8, ll. 54-64. Hence, the examiner's position has been that if silicon dioxide were added to the electrolyte mixture to be sintered (as Kobayashi and Nanataki provide motivation for), the crystal phase containing silicon dioxide would inherently have formed between the solid electrolyte layer and the insulating layer as evidenced by the instant invention and Fujishiro. Appellant does not appear to have set forth any evidence that the prior art's use of silicon dioxide to the electrolyte wouldn't have necessarily resulted in the formation of the claimed crystal phase containing silicon dioxide (e.g. that appellant's processing steps differ from the processing steps of the prior art and hence this crystal phase would be a phenomenological result of appellant's unique processing steps). Moreover, there doesn't appear to be anything unique about the processing steps of the instant invention that would substantively differ from the processing steps of any of the relied on prior art. In particular, appellant adds silicon dioxide to the electrolyte and sinters the sensor at 1500 °C (p. 14, ll. 28-30), which is a sintering temperature taught by Tatumoto (see claim 2), and very close to the sintering temperatures taught by both Kobayashi (col. 3, ll. 51-57) and Nanataki (col. 6, ll. 51-53).

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Furthermore, Fujishiro appears to establish that this silicon dioxide phase can occur in sintering temperatures ranging from 1200-1600 °C (col. 5, ll. 12-26).

Appellant also urges that the evidentiary teaching of Fujishiro differs from the instant invention in a number of ways. The examiner would initially note that appellant's large emphasis on Fujishiro in the appeal brief arguments is confusing because Fujishiro is only being utilized as a evidentiary teaching and is only being utilized in the alternative to what appellant's own disclosure already established. Appellant urges that the addition of silicon dioxide is only for  $\text{ZrO}_2\text{-CaO}$  ceramics. However, appellant's own disclosure gives no indication that this silicon phase is somehow unique to its yttria based ceramics, nor does Fujishiro appear to set forth any criticality concerning this silicon dioxide phase only forming for CaO based ceramics. Note that Fujishiro discloses both CaO and  $\text{Y}_2\text{O}_3$  based ceramics are known in the art (col. 3, ll. 13-15). Appellant also urges that Fujishiro also doesn't establish that silicon dioxide would form a strengthening bond between two ceramic sheets. However, as discussed in the January 12, 2007 advisory action, Fujishiro establishes that silicon dioxide placed into the electrolyte separates itself from the zirconia solid solution and rises to the surface of the solid electrolyte. This would presumably be true regardless of whether the electrolyte is bound by electrodes or by insulating sheets, or in the case of Tatumoto and the lower surface of electrolyte 2, both an electrode and an insulating sheet. Whether or not the silicon dioxide would separate itself from the zirconia would be a function of the solubility of silicon dioxide in the zirconia at the sintering temperatures and wouldn't be a function of what happens to be on the surface of the solid electrolyte layer. Furthermore, as discussed above, because Tatumoto's lower surface of electrolyte 2 contains both an electrode 31 and an insulating sheet 4, if silicon dioxide is rising to

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the lower electrolyte surface to assist in the bonding of electrode 31, then this same silicon dioxide would also be rising to the surface of electrolyte adjacent the insulating sheet 4.

Appellant's arguments concerning the rejections of claim 3 and claims 5 and 6 in the alternative appear to rely on the appellant's perceived failings of the earlier rejections.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Conferees:

Kaj K. Olsen

Romulo Delmendo

Nam X. Nguyen